

REVIEW ARTICLE

Knowledge and practice among healthcare workers of first aid management of burns: a systematic review

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ABSTRACT

Background: Burn injuries remain a significant global public health concern, and prompt, appropriate first aid is essential for reducing burn severity and improving outcomes. Healthcare workers (HCWs) play a critical role in providing early burn care and educating the public; however, their knowledge and practices regarding burns first aid may be suboptimal. This systematic review aimed to synthesize available evidence on HCWs' knowledge and practices related to burns first aid, assess participation in burn first-aid training, and identify factors associated with knowledge levels.

Methods: A systematic search of PubMed Newcastle–Ottawa Scale for cross-sectional studies.

Results: Six cross-sectional studies involving 3,123 healthcare workers from Saudi Arabia, Vietnam, India, and Jordan were included. Overall, HCWs demonstrated inadequate to moderate knowledge of burns first aid, with consistent gaps in burn size estimation, fluid resuscitation, and recognition of burn-related complications. Participation in formal burn first-aid training was limited. A systematic search of Scopus and Web of Science was conducted from inception to December 2025 in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Observational studies assessing burns first-aid knowledge or practices among HCWs were included. Data extraction was performed independently by two reviewers, and methodological quality was evaluated using the adapted from 10.1% to 32%. Studies consistently reported higher knowledge levels among trained participants, while gender and professional specialty were identified as significant predictors in one study. The methodological quality of the included studies ranged from moderate to high.

Conclusion: Healthcare workers across diverse settings exhibit important deficiencies in burns first-aid knowledge, underscoring the need for standardized and targeted educational interventions.

Keywords: Burns first aid, healthcare workers, knowledge, systematic review.

Introduction

Burn injuries impose a major global health burden, with an estimated 180,000 deaths per year worldwide (mostly in low- and middle-income countries) [1]. Nonfatal burns cause significant morbidity – prolonged hospital stays, disfigurement, and disability – and rank among the leading causes of lost healthy life years (DALYs) globally [1]. The toll is especially heavy in Asia and Africa. For example, World Health Organization (WHO) data show that India alone experiences over 1,000,000 moderate-to-severe burn injuries annually [1]. Prompt and correct

first aid can markedly reduce burn severity. International guidelines (WHO, Red Cross, NHS, etc.) unanimously recommend immediate cooling with copious running water for 15–30 minutes, plus removal of any constricting

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clothes or jewelry [2,3]. These simple steps dissipate heat, limit tissue damage, and relieve pain. Healthcare workers (HCWs) - including physicians, nurses, and paramedics - are often first responders to burns and educators in the community. They are expected to know and teach correct first-aid procedures. However, surveys from multiple countries reveal critical knowledge gaps among HCWs. Scores on burn first-aid assessments are often only moderate, and many unsafe practices persist. For example, a Saudi study ($n = 1,438$) found an average knowledge score of 8.07 ± 2.03 out of 13; notably, 65.4% of respondents reported using traditional remedies, and 82.3% wrongly believed antibiotics were beneficial for burns [4]. Similarly, an Indian survey found that only about 12% of participants (mostly HCWs) answered all burn first-aid questions correctly [5]. Across studies, formal burn first-aid training was uncommon (often <30% of HCWs), which may explain widespread misconceptions. Taken together, the high global incidence of burns and the proven impact of early care underscore the importance of HCW readiness. These findings suggest that many HCWs may be ill-prepared to deliver optimal first aid, potentially compromising patient outcomes. Therefore, we plan a systematic review of the observational literature to aggregate current international data on HCWs' burn-first-aid knowledge and practices. The aim of this systematic review is to synthesize recent evidence on healthcare workers' knowledge and practice of burn first aid. The specific objectives of this review were to summarize the reported levels of burn first-aid knowledge and the extent of correct first-aid practices among healthcare workers across different clinical settings. In addition, the review aimed to identify demographic, professional, and training-related factors associated with healthcare workers' levels of knowledge and practice. Finally, the review sought to highlight common knowledge gaps and unsafe practices, such as the use of traditional remedies, in order to inform the development of targeted educational interventions and evidence-based policy measures. By addressing these objectives, this study will quantify the scope of HCWs' preparedness in burn first aid and clarify priority areas for intervention. Improved understanding of global HCW first-aid literacy will guide development of training strategies, with the ultimate goal of ensuring faster, safer early burn care and better patient outcomes worldwide.

Methods

Study design and reporting standards

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [6]. The review aimed to synthesize available observational evidence on healthcare workers' knowledge and practices related to burns first aid at a global level.

Literature search and keywords

A comprehensive and systematic literature search was performed in PubMed, Scopus, and Web of Science

to identify relevant studies published from database inception up to December 2025. The search strategy was developed to capture studies addressing burns first aid among healthcare workers and incorporated both free-text terms and controlled vocabulary where applicable. The following search string was applied, with minor adaptations according to database-specific requirements: (burn OR "thermal injury" OR scald*) AND ("first aid" OR "initial management" OR "emergency management" OR "burn first aid" OR "burn management") AND ("health personnel"[Mesh] OR "healthcare worker*" OR "health care worker*" OR "medical staff" OR nurse* OR physician* OR doctor* OR "emergency responder*" OR paramedic*).

In addition, the reference lists of all included studies and relevant review articles were manually screened to identify any additional eligible publications that may not have been captured through the electronic search.

Eligibility criteria

Studies were considered eligible for inclusion if they met all of the following criteria:

1. Study design: Observational studies, including cross-sectional and cohort designs.
2. Population: Healthcare workers of any category (e.g., physicians, nurses, paramedics, emergency responders, and allied health professionals), regardless of age, sex, specialty, or healthcare setting.
3. Outcome: Studies that assess knowledge, practice, attitudes, or preparedness related to burns first aid, or initial burn management.
4. Setting: Studies conducted in any country or region worldwide.
5. Publication characteristics: Full-text articles published in peer-reviewed journals in the English language.

Exclusion criteria

Studies were excluded if they met any of the following criteria:

1. Non-original publications, including reviews, systematic reviews, meta-analyses, editorials, commentaries, letters, protocols, theses, conference abstracts, or case reports.
2. Studies conducted exclusively among non-healthcare populations (e.g., students without clinical roles or members of the general public).
3. Studies with insufficient, unclear, or non-extractable data related to burns first-aid knowledge or practice.

Study selection

All identified records were exported, and duplicates were removed prior to screening. The remaining citations were uploaded into the Rayyan software for blinded study selection [7]. Two reviewers



independently screened titles and abstracts for potential eligibility based on the predefined inclusion and exclusion criteria. Full texts of potentially relevant studies were subsequently retrieved and assessed for final inclusion. Any disagreements during the screening or selection process were resolved through discussion and consensus between the reviewers.

Data extraction

Data extraction was performed independently by two authors using a standardized electronic data extraction form. Extracted data included the following elements:

- Study characteristics: first author, year of publication, country or region, study design, sample size, and key findings.
- Participant characteristics: type of healthcare worker, age distribution, gender, and burn first aid training experience or course.
- Outcomes of interest: level of knowledge regarding burns first aid, reported first-aid practices, participation in burn first-aid training or educational courses, and factors associated with knowledge or practice (e.g., profession, training exposure, demographic variables).

Any discrepancies in extracted data were resolved through discussion and review of the original articles.

Risk of bias assessment

The methodological quality of the included studies was independently assessed by two reviewers using the Newcastle-Ottawa Scale (NOS) adapted for cross-sectional studies [8]. The assessment focused on key domains, including sample representativeness, adequacy of sample size, measurement of burns first-aid knowledge or practice, and control for potential confounding factors. Disagreements in quality assessment were resolved by consensus.

Results

Literature search

The electronic database search identified 609 records. After removing duplicates, 535 records were screened based on titles and abstracts, of which 33 articles were retrieved for full-text review. Following a detailed eligibility assessment, six cross-sectional studies were included in the systematic review [4,5,9-12]. The study selection process is summarized in the PRISMA flow diagram (Figure 1).

Study and population characteristics

A total of six cross-sectional studies were included, encompassing 3,123 healthcare workers from Saudi Arabia, Vietnam, India, and Jordan. Sample sizes ranged from 119 to 1,438 participants. The study populations included physicians, nurses, medical students, paramedics, and other healthcare professionals working in diverse clinical settings. Two studies were conducted in Saudi Arabia, while the remaining

studies were undertaken in Vietnam, India, and Jordan. Participant age was variably reported, with most studies indicating a predominance of young to middle-aged adults, particularly those aged between 21 and 40 years. Where sex distribution was reported, males constituted between 31.7% and 59.7% of participants. Participation in formal burn first-aid training was generally low, ranging from 10.1% to 32%, with two Vietnamese studies reporting training exposure in approximately one-tenth of participants. Across studies, healthcare workers consistently demonstrated inadequate to moderate knowledge of burns first aid, particularly in advanced management areas such as burn size estimation, fluid resuscitation, and recognition of burn-related complications. A summary of the study characteristics and key findings is presented in Table 1.

Quality assessment

The methodological quality of the included studies was assessed using the adapted NOS for cross-sectional studies. As presented in Table 2, overall NOS scores ranged from 6 to 8 out of 10, indicating moderate to high methodological quality. All studies achieved good scores for ascertainment of exposure, outcome assessment, and appropriateness of statistical analysis. However, several studies lost points due to limitations in the non-respondents domain. Comparability, reflecting control for potential confounding factors, was adequately addressed in most studies. Overall, the quality assessment suggests that the included studies provide a reliable evidence base for synthesizing findings on healthcare workers' knowledge of burns first aid, despite some methodological limitations.

Level of knowledge of burns first aid among healthcare workers

Across the included studies, healthcare workers' knowledge of burns first aid demonstrated marked variability both between studies and across specific knowledge domains. In Fathuldeen et al. 2023 [11], physicians showed moderate performance in selected aspects of burn assessment and management; just over half of participants (57.1%) correctly addressed circulation during primary assessment, while fewer were able to identify burn injury mechanisms (42%) or accurately estimate burn degree (67.2%). Although younger physicians, surgeons, and those with fewer than 5 years of experience achieved slightly higher mean knowledge scores, these differences were not statistically significant, indicating relatively uniform knowledge gaps across subgroups. In Mortada et al. [4], while two-thirds of respondents correctly identified cooling with water as the appropriate first-aid measure, a substantial proportion continued to endorse inappropriate practices, including the use of traditional remedies (65.4%). Knowledge of electrical burns was comparatively strong, with over 90% responding correctly, yet overall knowledge varied significantly by age, sex, nationality, and job position.



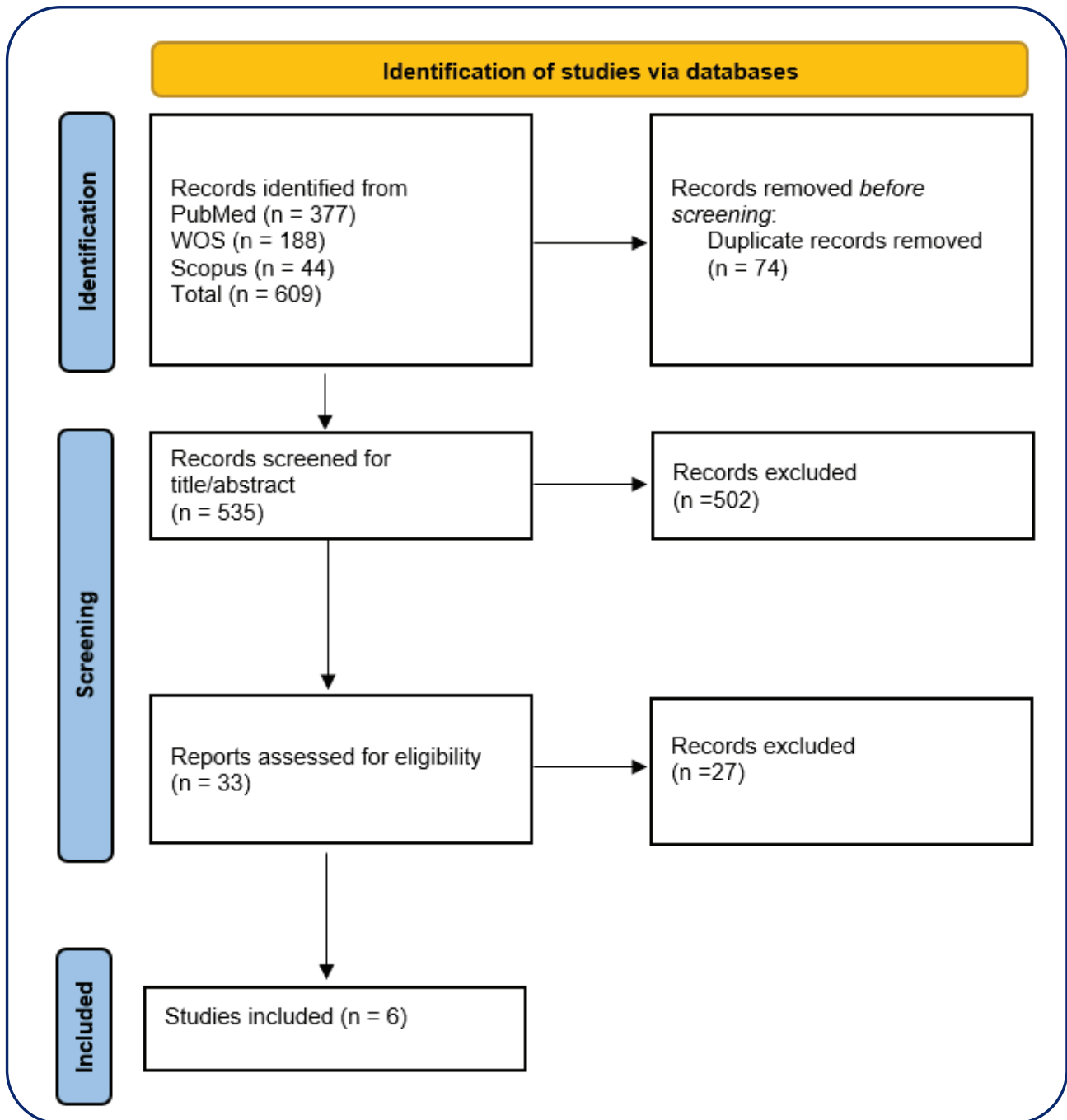


Figure 1. PRISMA flowchart of study selection.

The study by Qasaimeh et al. [12] reported a moderate overall level of burn first-aid knowledge, with a mean score of 26.58 out of 33; however, more than half of the participants (52.1%) were categorized as having poor knowledge. Participants demonstrated a strong understanding of basic concepts such as burn causes, removal of clothing and jewelry, and burn surface area estimation methods, but notable gaps persisted in fluid selection and early wound care practices. In Hegde et

al. [5], overall knowledge was limited, with only 16% of healthcare workers answering all questions correctly. Nurses achieved the highest scores compared with physicians, medical students, and paramedical staff, and female participants contributed a greater proportion of correct responses than males, highlighting variation by professional role and sex.

Findings from Lam et al. [9,10] further illustrated inconsistencies in burn first-aid knowledge among



Table 1. Summary of the included study characteristics.

| Study (Author, Year) | Sample size (n) | Country | Design | Sex, male n (%) | Age, range n (%) | Burn first aid training experience or course (%) | Occupation (%) | Key finding |
|------------------------------|-----------------|--------------|-----------------|-----------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fathuldeen et al. 2023 [11] | 119 | Saudi Arabia | Cross-sectional | 71 (59.7) | 25-29: 23 (19.3) 30-34: 13 (10.9) 35-39: 38 (31.9) 40-44: 19 (16) 45-50: 10 (8.4) >50: 16 (13.4) | 15 (12.6) | Physicians: 119 (100) | The majority of physicians demonstrated inadequate practical understanding of appropriate burn management, and most had not received formal training in burn first aid. This highlights the need for additional educational programs specifically aimed at physicians who are likely to encounter burn patients. |
| Mortada et al. 2020 [4] | 1438 | Saudi Arabia | Cross-sectional | 456 (31.7) | 19-21: 372 (25.9) 22-29: 720 (50.1) 30-39: 210 (14.6) 40-50: 102 (7.1) >50: 34 (2.4) | 249 (17.3) | Medical student: 513 (35.7) Medical intern: 204 (14.2) Resident: 223 (15.5) Specialist: 79 (5.5) Consultant: 122 (8.5) Nurse: 297 (20.7) | Awareness of burn first aid among healthcare workers was found to be inadequate, with a high prevalence of unnecessary use of traditional remedies and antibiotics in burn cases. Furthermore, the study emphasized the need to implement effective educational programs for healthcare workers. |
| Qasimeh et al. 2025 [12] | 383 | Jordan | Cross-sectional | 168 (43.9) | <30: 259 (67.6) 30-40: 89 (23.2) >40: 35 (9.1) | NA | Medical doctor: 292 76.2% Nurse: 83 21.7% Paramedic: 8 2.1% | This study demonstrated an overall moderate level of understanding of burn first aid among healthcare providers, although more than half had insufficient knowledge. Gender and professional speciality were identified as significant factors, with higher knowledge levels observed among males and physicians, particularly general surgeons. |
| Hegde et al. 2024 [5] | 433 | India | Cross-sectional | 171 (40) | < 20: 34 (8) 21-30: 273 (63) 31-40: 93 (22) 41-50: 19 (4.7) >50: 14 (2.3) | 142 (32) | Doctors: 150 (35) Nurses: 74 (17) Medical students: 154 (36) Paramedical: 55 (12) | There is a clear need for proper training in burn first aid, given the low level of awareness among both healthcare workers and non-healthcare workers. Participation in burn first aid courses and direct experience in managing burn cases were associated with better knowledge of burn prevention and first aid. In addition, leveraging different media platforms may be an effective approach to disseminate information to a wider population, particularly in remote and hard-to-reach areas. |
| Lam et al. 2018 (nurses) [9] | 353 | Vietnam | Cross-sectional | NA | NA | 36 (10.2) | Nurses: 353 (100) | Nurses who had previously participated in training courses demonstrated significantly higher levels of knowledge, whereas work experience and workplace setting had no significant impact. To enhance nurses' competence in burn emergency management, ongoing and additional educational programs are strongly recommended. |



| Study (Author, Year) | Sample size (n) | Country | Design | Sex, male n (%) | Age, range n (%) | Burn first aid training experience or course (%) | Occupation (%) | Key finding |
|-----------------------------------|-----------------|---------|-----------------|-----------------|------------------|--------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lam et al. 2018 (Physicians) [10] | 397 | Vietnam | Cross-sectional | NA | NA | 40 (10.1) | Physicians: 397 (100) | Physicians who had previously attended training courses demonstrated significantly higher knowledge scores than those who had not. Multivariable logistic regression analysis showed that these factors independently influenced healthcare providers' knowledge levels. Accordingly, continued medical education on burn management and mass burn casualty response is strongly recommended, particularly for physicians working in primary healthcare settings. |

Table 2. Quality assessment of the included studies using NOS.

| Study ID | Selection | | | Comparability | Outcome | | Total (out of 10) |
|------------------------------|----------------------------------|-------------|---------------------------|---------------|-----------------|-----------------------|-------------------|
| | Representativeness of the sample | Sample size | Ascertainment of exposure | | Non-respondents | Assessment of outcome | |
| Fathuldeen et al. [11] | ★ | ★ | ★ | - | ★★ | ★ | 7 |
| Hegde et al. [5] | ★ | ★ | ★ | - | ★★ | ★ | 7 |
| Lam et al. [9] (nurses) | ★ | ★ | ★ | - | ★ | ★ | 6 |
| Mortada et al. [4] | ★ | ★ | ★ | ★ | ★★ | ★ | 8 |
| Qasaimeh et al. [12] | ★ | ★ | ★ | ★ | ★★ | ★ | 8 |
| Lam et al. [10] (Physicians) | ★ | ★ | ★ | - | ★ | ★ | 6 |

* Criterion fulfilled/clearly reported in the study.

** Criterion partially fulfilled, inadequately reported, or unclear in the study.



both nurses and emergency physicians. Among nurses, awareness of immediate cooling with water was high (93.2%), and most correctly rejected traditional remedies; however, critical deficiencies were observed in burn size calculation (7.7%), fluid resuscitation parameters, and triage decision-making [9]. Similarly, emergency physicians demonstrated good knowledge of initial cooling and eye burn management but performed poorly in estimating burn extent, understanding burn shock physiology, electrolyte disturbances, and appropriate fluid resuscitation targets [10]. Across both cohorts, training exposure - rather than years of experience - was significantly associated with better knowledge

Participation in burns first aid training and educational courses

Across the included studies, participation in formal burn first-aid training or courses was generally low, ranging from approximately 10% to 32%. The lowest reported participation rates were observed in the Lam et al. [9,10] studies among nurses (10.2%) and physicians (10.1%), as well as in Fathuldeen et al. (12.6%) [11]. Mortada et al. [4] reported that 17.3% of participants had attended a burn training course, while Hegde et al. [5] demonstrated a relatively higher proportion, with 32% of HCWs reporting prior training. Data on training participation were not available in Qasaimeh et al [12]. Overall, these findings highlight limited exposure to structured burn first-aid education among HCWs, which may partly explain the observed deficiencies in knowledge, particularly in specialized or decision-intensive aspects of burn management.

Factors associated with burns first aid knowledge

In Qasaimeh et al. [12], multivariable analysis demonstrated that both gender and professional specialty were significantly associated with burn first-aid knowledge. Female healthcare providers were less likely to demonstrate adequate knowledge compared with males, with this association reaching borderline statistical significance (OR = 0.64; 95% CI: 0.41-1.00; $p = 0.05$). In contrast, clinical specialty was a strong predictor of higher knowledge levels; general practitioners (OR = 3.24; 95% CI: 1.24-8.49; $p = 0.017$), family medicine specialists (OR = 3.76; 95% CI: 1.37-10.36; $p = 0.010$), and general surgeons (OR = 8.96; 95% CI: 1.85-43.33; $p = 0.006$) exhibited significantly greater odds of adequate burn first-aid knowledge compared with non-physician participants.

Discussion

This systematic review of six cross-sectional studies found that HCWs in diverse settings often lack adequate knowledge and practice regarding burn first aid. For example, Fathuldeen et al. [11] reported that most Saudi physicians demonstrated poor practical knowledge of burn management and had never received specific burn first-aid training. Similarly, Qasaimeh et al. [12]

found that 52.1% of Jordanian HCWs had inadequate burn first-aid knowledge. In India, Hegde et al. [5] showed that only 11.8% of respondents answered all five burn first-aid scenarios correctly. Even in Vietnam, Lam et al. [10] found that only 39.8% of emergency physicians scored above 50% on burn emergency management questions. Where assessed, receiving training correlated with better scores [5,10]. In short, across Saudi Arabia, Jordan, India, and Vietnam, HCWs generally scored modestly better than the lay public, but knowledge gaps and suboptimal practices were evident in all cohorts.

These findings carry important implications in light of global burn epidemiology. Burns are a major worldwide health problem: an estimated 180,000 deaths occur annually from burns, the vast majority in low- and middle-income countries [1]. Non-fatal burns also cause substantial disability and resource use. Prompt and correct first aid is known to substantially mitigate burn severity: accurate, timely first aid improves survival and functional recovery and can significantly reduce the severity of burn injuries and deaths. Because HCWs are frontline responders to burn injuries (often managing patients in emergency or primary care before specialist referral), their competence in burn first aid is critical. If HCWs lack up-to-date first-aid knowledge, opportunities to minimize damage (e.g., cooling burns, removing clothing, and preventing contamination) may be missed. In this context, our review underscores that even HCWs in upper-middle-income countries show worrisome deficits, suggesting that global burn care would benefit from bolstered first-aid capacity at all levels.

Across studies, physicians and nurses who had attended burn-specific courses performed significantly better: Lam et al. [10] reported mean knowledge scores of 53.1% versus 44.5% for trained versus untrained doctors ($p = 0.0003$) [10], and Hegde et al. [5] noted that burn-first-aid courses modestly improved correct responses ($p = 0.052$) [5]. Nonetheless, such training was uncommon: only 10.1% of Vietnamese doctors had burn management training [10], and Fathuldeen et al. [11] found that most Saudi physicians “had not engaged in burn first aid training” [11]. Thus, the literature suggests that lack of formal education (both undergraduate and continuing) is a key driver of the observed knowledge shortfall.

The deficits uncovered by this review suggest a clear role for policy interventions. Health authorities and institutions should mandate regular, standardized burn first-aid training for HCWs. For example, national curricula and hospital credentialing could require certification in first-aid skills that explicitly include burn management. Guidelines from international bodies already emphasize first aid; our findings support policies to ensure compliance. Such mandates might include incorporating burn-first-aid modules into occupational health and safety regulations, disaster



preparedness plans, or basic life support requirements. By making burn first-aid training obligatory - rather than optional - policymakers can help ensure that all frontline providers acquire evidence-based skills. Clinical practice implications: In day-to-day care, knowledge deficits likely translate into suboptimal patient outcomes. For example, failure to apply cool water, incorrect fluid resuscitation, or inappropriate coverings can exacerbate tissue damage. The reviewed studies collectively imply that many HCWs currently lack the routine skills to provide an ideal first response. To mitigate this, hospitals and clinics should reinforce evidence-based burn protocols. Regular skills assessments (perhaps via drills or audits) could identify misconceptions. Clinicians themselves should be aware of their knowledge gaps; institutional “just-in-time” training or posters highlighting key first-aid steps may be useful. Ultimately, ongoing professional development is needed to ensure that emerging clinicians do not inherit outdated practices. In summary, bridging these knowledge gaps in clinical practice is critical to closing the loop on burn care quality.

Given the identified gaps, future research should aim to expand and deepen our understanding of HCW burn-first-aid competence. Larger, multicenter studies are needed in more regions (especially Africa and Latin America) to gauge global patterns. Longitudinal studies could assess how interventions (e.g., training programs) change knowledge and practice over time. Qualitative research exploring barriers to training uptake would be valuable. Importantly, future work should evaluate the impact of improved HCW first-aid training on patient outcomes (e.g., burn severity, healing time, and complications). Finally, developing and validating standardized assessment tools for burn first-aid knowledge would facilitate benchmarking and periodic monitoring. These research directions will help ensure that training initiatives are evidence-based and lead to measurable improvements in burn care.

Conclusion

This systematic review demonstrates that healthcare workers across multiple countries often possess insufficient or only moderate knowledge of burns first aid, despite their critical role as first responders and educators. Deficiencies were particularly evident in advanced aspects of burn management, including burn size estimation, fluid resuscitation, and early complication recognition. Participation in formal burn first-aid training was consistently low, yet strongly associated with better knowledge, highlighting education as a key modifiable factor. These findings emphasize the need for structured, evidence-based burn first-aid training integrated into undergraduate curricula, continuing professional development, and institutional policies. Strengthening healthcare workers’ first-aid competence has the potential to improve

early burn care, reduce preventable complications, and ultimately enhance patient outcomes at both community and healthcare system levels.

List of Abbreviations

| | |
|--------|--------------------------------------------------------------------|
| DALY | Disability-adjusted life year |
| HCWs | Healthcare workers |
| ICMJE | International Committee of Medical Journal Editors |
| NOS | Newcastle-Ottawa Scale |
| PRISMA | Preferred Reporting Items for Systematic reviews and Meta-Analyses |

Conflict of interest

The authors declare that they have no competing interests.

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Consent for publication

Not applicable.

Human ethics and consent to participate statement

Our manuscript was not applied to human beings and thus requires no formal ethical approval.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors’ contributions

The authors meet the criteria for authorship as recommended by the International Committee of Medical Journal Editors (ICMJE).

Ethics approval and consent to participate

Not applicable.

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